A. COVER SHEET

Water Use Efficiency Program
Proposal Solicitation Package

1. Specify: agricultural project or urban project; individual or joint application

2. Proposal Title: **3 -Year Technical Assistance Program to Irrigation Districts to partially address all of the CALFED Quantifiable Objectives**

3. Principal applicant: **California Polytechnic State University**
Irrigation Training and Research Center

4. Contact: **Dr. Stuart Styles**
Director

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9. Funds requested: **$300,000**

10. Cost Share: **$300,000**

11. Duration: **July 2001 to June 2004**

12. State Assembly/Senate districts and Congressional Districts where project is to be conducted: **Affects all irrigated portions of CA**

13. Location and geographic boundaries of the project: **State of California**

14. Name and signature of official representing applicant. By signing below, the applicant declares the following:
- the truthfulness of all the representations in the proposal;
- the individual signing the form is authorized to submit the application on behalf of applicant;
- the applicant will comply with contract terms and conditions identified in Section 11 of PSP.

Dr. Stuart W. Styles February 13, 2001

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B. SCOPE OF WORK

1. Abstract

This is a proposal for a 3-year agreement to provide technology transfer to water users, as well as to identify new opportunities for water conservation and improved water management for irrigation districts in California. This proposal addresses "all" of the CALFED Quantifiable Objectives by assisting irrigation districts with their implementation. Cal Poly Irrigation Training and Research Center is proposing a technical services program to mirror an existing program sponsored by the USBR Mid-Pacific Region. Since the start of the program in 1994, an estimated $2.1 million dollars have been expended by irrigation districts as a result of participation with the ITRC in the technical services program. All of the projects were the result of modernization of the district operations and represent cash outlays by the district. This does not include the additional cost incurred by the districts for equipment, labor, or facilities use. This cost share component of the USBR contract with ITRC represents well over a 50% cost share by the local irrigation districts to participate in this modernization effort. Due to many requests from irrigation districts outside of the USBR Mid-Pacific Region, this proposal would expand this popular program to include all of the districts in California.

2. Statement of Critical Issues

The Mid-Pacific Region of the USBR has implemented an aggressive Water Conservation program. Cal Poly San Luis Obispo ITRC has assisted the Mid-Pacific Region since October 1994 by providing technical assistance to irrigation districts. It is a valuable extension to the USBR's in-house expertise, and has met with widespread approval by USBR customers.

The USBR technical assistance program in partnership with the ITRC has been identified as a **positive** program by the irrigation districts. Irrigation districts are actively pursuing modernization efforts, but they need specialized, high-level outside assistance to enhance their in-house and traditional engineering expertise. This USBR technical assistance program has multiplying benefits because it allows the districts to allocate financial resources spend their own (and CALFED) funds more wisely, while serving as good examples for neighboring districts. The program also fills an information transfer gap in important subjects such as irrigation scheduling and on-farm irrigation system design.

The technical assistance program is targeted towards the end-users (water district personnel and farmers) of the information, and towards individuals and organizations (such as irrigation dealerships) that have a multiplying effect. It addresses the "how to" questions that always accompany policy changes.

ITRC has provided unique multiple resources through the following:

- Access to excellent training facilities at Cal Poly SLO, including the unique Water Delivery Modernization Facility, the John Merriam On-Farm Irrigation Practices Field, and the ITRC conference rooms.
- Prior experiences in a wide range of successful water conservation and drainage reduction programs, both national and international, with urban and agricultural aspects.

- Excellent contacts among water district personnel and the private irrigation sector.
- Intimate ties with the large Cal Poly SLO irrigation/drainage teaching program.
- Concurrent projects with other agencies and private organizations, which have enhanced and complimented USBR water conservation efforts.
- Special expertise in such topics as Supervisory Control and Data Acquisition (SCADA) systems, canal and pipeline automation, flow measurement, and on-farm irrigation.

There have been numerous requests from irrigation districts that are not covered by the USBR Technical Services agreement. A partial list of these districts include Merced Irrigation District, Turlock Irrigation District, Modesto Irrigation District, Western Canal Water District, and Alta Irrigation District. The services provided by this proposal would address the following EWMPs:

EWMP6. Increase flexibility in water ordering by, and delivery to, the water users within operational limits.
EWMP7. Construct and operate water supplier spill and tailwater recovery systems.
EWMP8. Optimize conjunctive use of surface and groundwater.
EWMP9. Automate canal structures.
EWMP10. Water Measurement and Water Use Report.

3. Nature, Scope, and Objectives of the Project

This grant has two major components. The first component will be a variety of programs targeting all of the agricultural water users in the state of California. The second component will target the benefits to individual irrigation districts.

Training, Special Studies, and Technology Transfer Programs.
This will include:

- Training classes to be held both at ITRC and at the irrigation districts. These classes include subjects such as:
  - Water delivery modernization
  - Basic principles for ditchriders and water masters
  - Flow measurement
  - On-farm irrigation system design
  - On-farm irrigation system management
- Special studies, as needed for purposes such as identifying water conservation potentials, or understanding cause/effect/solutions for technical problems.
- Participation in seminars and workshops.
- In-house specialty training for USBR/DWR/AWMC and other state agency personnel.
- Develop newsletter articles and reports on study results, demonstrations and new technologies directed at informing and educating irrigation district personnel and irrigation professionals.

Direct Technical Assistance to Individual Irrigation Districts

The ITRC will provide independent technical expertise for specific water conservation programs for individual districts, at their request. This may include:

- Reviews of modernization and water management plans.
- Use of RAP (Rapid Appraisal Process) for identification of modernization needs.
- Development of guidelines and assistance with quality control for districts which may be interested in setting up on-farm irrigation evaluation and scheduling programs.
- Review of plans or guidelines prepared by consulting engineers for irrigation district modernization or water management programs.
- Assistance with the implementation of SCADA (Supervisory Control and Data Acquisition) systems
- Assistance with implementation of flow measurement programs
- Assistance with other modernization efforts, such as improving pumping plant operations, water ordering, pressure control, etc. for improved water and energy management.

4. Methods, Procedures, and Facilities

The following information provides the details on the components. The ITRC has been providing short courses and training since 1989.

Component 1. Training, Special Studies, and Technology Transfer Programs

a. Training Classes.

Water Delivery Modernization Training.

It is desirable from on-farm irrigation efficiency and agronomic standpoints that irrigation district water delivery networks (pipelines and/or canals) deliver water with a high degree of flexibility and reliability. One aspect of modernization is financial; physical improvements are often quite expensive. An equally important aspect is awareness of modernization needs and options. The successful "School of Irrigation for Irrigation Districts", which has been held annually in the Fall at ITRC, will be continued. This school provides two sets of classes; one for irrigation district operators, and another for managers and engineers. The classes vary from 1-2 days in length each, and cover topics such as:

- Flow measurement in canals
- Flow measurement in pipelines
- General principles of modernization
- Advanced concepts in canal modernization
- SCADA systems
- Determining district water balances
- Hand Held Data Recorders

Water Conservation Coordinator Training

The Agricultural Water Management Council and USBR require a designated water conservation coordinator from each irrigation district as part of their water management plan. The ITRC has developed materials and curriculum to assist the water conservation coordinators in developing and implementing effective water management plans. This 1-2 day training will be updated annually and provided as part of the Irrigation District Training Classes.

Annual Designer/Manager School of Irrigation.
This 2-week school has been developed and held at the ITRC for the last 10 years. This is an excellent program for persons who are designing and managing on-farm irrigation systems. There is no other such technical program available for these people in California. The need is very basic: Unless irrigation designers know how to properly design an irrigation system for good uniformity and simple management, on-farm irrigation efficiencies will be low. Typically, irrigation system designers have no formal university irrigation training and they must have this type of class available in order to supplement their rudimentary hands-on, on-the-job training. ITRC works closely with The Irrigation Association in its Designer Certification program to help certify designers; these classes help designers prepare for those exams.

This proposal will help support the continuation of the Annual Designer/Manager School of Irrigation. The goals are directly in line with CALFED's QOs to improve on-farm irrigation, reduce drainage problems, and enhance groundwater and surface water qualities. Other funding partners for this program may include the California Energy Commission, and contributions from private industry.

Classes provided in this school will include:

- Basic soil/plant/water relationships (1 day)
- Basic hydraulics (1 day)
- Basic pumps (1 day)
- Advanced pumps (2 days)
- Row crop drip irrigation (1 day)
- Fertigation (1 day)
- Drip system design (3 days)
- Irrigation scheduling, salinity, and drainage (2 days)
- Sprinkler irrigation design (2 days)

Local 1 Day Classes on Flow Measurement, Irrigation District Operation, SCADA, On-Farm irrigation scheduling, and other topics.
Many districts need support for occasional short courses for their system operators, board members, and farmers. Examples completed from the existing contract with USBR include:

- Five talks were given in Glenn-Colusa ID, together with district management, to farmers about the need to work as a team towards modernization (and what that means). A special talk was given to board members

- Panoche WD received short courses for on-farm irrigators, including outdoor demonstrations of how to properly furrow irrigate for pre-irrigations.
- Meetings were held with board members of Delano-Earlimart Irrigation District to help them understand the importance of SCADA systems and modifications to their turnouts.
- ITRC participated in ACWA and CII meetings with USBR Water Conservation staff to present opportunities for districts to improve their water management.

On-Farm Irrigation Evaluation.
In the early 1980's, the ITRC developed, on behalf of the Water Conservation Office of the Calif. DWR, a 2.5 day class on Irrigation Evaluation techniques. That class has been offered twice per year since then with DWR funding. This class will continue to make a very important contribution to water conservation in California. It provides a standardized format for definitions of Irrigation Efficiency, and for the procedures to be used in measuring Irrigation Efficiency and Distribution Uniformity for on-farm irrigation. As a result of this standardized training, it is now much easier for persons to communicate regarding irrigation efficiency. Without continued training, there will be a wide mix of varying perceptions of what irrigation efficiency is, and how it can be measured. A clear perception is absolutely necessary if valid water conservation programs within districts are to be developed.

b. In-house DWR/USBR Training and Support.
Special training and classes for DWR/USBR personnel will be available, on request, regarding topics related to irrigation and drainage. Topics can include irrigation evaluation, water delivery modernization, drainage, water quality, and irrigation scheduling. Classes can be small and individualized, to immediately assist the Water Conservation staff in their efforts.

c. Special Studies.
This action item includes the provision to conduct short, well defined special studies, which may be needed. Such studies may range from quantification of evaporation losses from sprinklers to participation of ITRC personnel in DWR/USBR brain-storming sessions. It may also include larger studies such as the definition of the Irrigation Efficiency in some. Such studies will only be done after thorough consultation with the CALFED program manager. Examples of such studies, which occurred during the USBR Technical Services contract, are:

- Clarification of Irrigation Efficiency, Irrigation Sagacity, and Distribution Uniformity concepts and definitions. This work resulted in a published report through the American Soc. of Civil Engineers, Water Resources Division. It is very important for districts which are considering water transfers.
- Development, testing, and calibration of a simple flow measurement device for Solano Irrigation District fixed rate accounts. SID needed a simple and inexpensive flow measurement device for its small land holdings that presently receive water from a simple alfalfa valve. ITRC tested a simple vertical pipe with a notched weir; the device met the requirements of simplicity and accuracy.

- Development of the ITRC Flapgate - a simple automatic upstream control gate which is inexpensive and requires no external power. This gate was designed and installed in Chowchilla WD. Development work continues.
- Definition of a procedure to make automated canal gates work equally well at high flow rates and low flow rates. Canal gates typically work well in either one of those conditions, but not in both. A procedure was developed to characterize gates and insert a correction factor in the controller code, which eliminates this problem and provides stable control.

d. Water Measurement

Water measurement is a requirement of the Central Valley Project Improvement Act. In certain areas of the Mid-Pacific Region, irrigation districts have had difficulty implementing cost effective water measurement to individual water users to meet is requirement. ITRC will perform studies and possibly participate in local demonstrations to help identify low cost appropriate methods of water measurement to individual water users. Two main areas of emphasis are the rice growing regions of the Sacramento Valley and small acreage ranchettes in Placer and Solano Counties.

Component 2. Direct Technical Assistance to Individual Irrigation Districts

a. The ITRC will provide abbreviated, independent reviews of modernization and water conservation plans for districts.

The key feature of this action item is that assistance will only be provided at the request of individual districts or in conjunction with loan/assistance programs offered through the USBR to districts. The assistance may take several forms; some possibilities are the following:

- Visits to districts to review operation plans and to help the district develop a strategy for improved water delivery.
- Development of guidelines and assistance with quality control for districts which may be interested in setting up on-farm irrigation evaluation and scheduling programs.
- Review of plans or guidelines, which have been, prepared by consulting engineers for irrigation district modernization or water conservation programs.

This program has met with considerable success. For instance, ITRC reviewed Santa Ynez River Water Conservation District's plans for SCADA modernization. ITRC recommendations resulted in a revised cost estimate of $80,000 (as opposed to an earlier estimate of about $200,000).

b. RAP - Rapid Appraisal Process.

Cal Poly ITRC has pioneered work on a similar rapid appraisal method for irrigation district modernization. Specifically, ITRC frequently conducts rapid appraisals for irrigation districts throughout the Mid-Pacific Region through our current 5-year technical assistance agreement with USBR or through direct contracts with individual irrigation districts. Approximately forty

such appraisals have been conducted in the U.S. The U.S. ITRC procedure has been informal, and relies upon the experience and technical knowledge of key ITRC personnel. A typical ITRC appraisal requires 1-2 days of field time, plus 2-4 days of office time. Additional time is required to develop specific engineering recommendations for Supervisory Control and Data Acquisition Systems, flow measurement, or specific canal gate automation algorithms.

In the international arena, ITRC has standardized a rapid appraisal for the specific needs of international projects (FAO Water Report 19). The international RAP requires 3-5 days in the field, plus approximately 2 weeks in the office. As an integral part of the existing appraisal, the authors developed a series of Internal Indicators and External Indicators that assist the evaluators to target the most critical needs for modernization. Internal Indicators quantify such factors as the level of water delivery service provided to customers, the suitability of various structures for meeting operational goals, constraints in management, operation, or hardware for future improvements, etc. External indicators quantify such factors as district irrigation efficiency, relative water supply, and crop yield per unit of evapotranspiration (ET).

c. Assistance with irrigation district modernization implementation.
ITRC has found that once irrigation districts decide to modernize, they may need periodic technical assistance during the implementation of district improvements. It is anticipated that periodic limited assistance will be provide to those districts that have begun to modernized based on prior ITRC recommendations. This may include assisting districts during their first attempts at implementing new approaches and by working with the districts and their consulting engineers and equipment firms to facilitate implementation of the new technologies. Examples of technologies, which have required assistance, are:
    - Water ordering software development
    - Remote monitoring and remote control systems
    - Automation of pumping plants which supply canals
    - The use of Variable Frequency Drive pumps
    - Hand Held Data Recorders for downloading turnout information
    - Flow measurement programs

d. Certain CALFED functions require specialized technical support.
Certain facilities are undergoing modernization and that effort has received strong technical assistance from ITRC via the present USBR contract. It is anticipated that the districts implementing actions for CALFED will need technical assistance in such areas as monitoring river flows and diversions. In addition, the USBR may ask the ITRC to provide technical review of water conservation reports prepared by other agencies or groups or through separate grants with other parties.

e. Water Balance Studies.
ITRC has noted that many of the numbers which individual irrigation districts use as facts when describing evapotranspiration and consumptive use have considerable margins of error. As the competition for water resources intensifies, it will become more important to improve our

estimates of water balances within regions and districts - i.e., to determine exactly how much water enters and exits various boundaries (surface, subsurface, and atmospheric).

This proposal is an action-specific proposal that incorporates actions that will address all of the CALFED Quantifiable Objectives. The proposed Technical Services will help districts with the implementation of projects that will reduce true irrigation system losses.

5. Schedule

The following is a simple bar chart for the proposed program.

3-Year Technical Services for Irrigation Districts

Tasks	Year 1	Year 2	Year 3
Component 1. Training, Special Studies, and Technology Transfer Programs			
Training Classes			
In-house DWR/USBR Training and Support			
Special Studies			
Water Measurement			
Component 2. Direct Technical Assistance to Individual Irrigation Districts			
Review of Modernization plans			
RAP - Rapid Appraisal Process			
Assistance with irrigation district modernization implementation			
Certain CalFed functions require specialized technical support			
Water Balance Studies			
	$100,000	$100,000	$100,000

Estimate of $25,000 per quarter.

6. Monitoring and Assessment

It is anticipated that the technical services provided to the irrigation districts proposed in this program will help irrigation districts with their ultimate decrease in available water supplies. Since most irrigation district management has realized that they must modernize in order to help their farmers survive, this technical services program will be essential to help districts form modernization strategies.

This program will also help districts in the formulation of their plans to document the results within their boundaries. Accurate water balances will be the key to determining whether the CALFED funded activities were successful.

C. OUTREACH, COMMUNITY INVOLVEMENT, AND INFORMATION TRANSFER

1. Outreach

The technical services will be provided to some irrigation districts that traditionally have not been able to afford for irrigation professionals to review the district operations. Some irrigation districts have been set up and operated for almost 100 years with a simple, yet flexible water supply. These districts will be the ones most impacted with tightening water supplies.

2. Training, Employment, and Capacity Building

The ITRC proposal will provide training to irrigation district personnel. It is estimated that about 400 persons receive training every year. The ITRC employs 30 persons. About 20 of these are students who are provided with an excellent opportunity to receive professional engineering training. This proposal will directly increase the base of students trained in irrigated agriculture who will contribute professionally after graduation in improving water management in California.

3. Information Dissemination

a. An annual report will be published on the Cal Poly ITRC web pages (www.itrc.org).
b. Articles will be supplied to USBR Mid-Pacific Region Water Conservation Office newsletter.
c. Articles will be supplied to Calif. DWR Water Conservation Office newsletter.

D. QUALIFICATIONS

1. Resumes

The resume for Dr. Stuart Styles is attached. Others who will be participating in the technical services include Dr. Charles Burt, Keith Crowe, Andy Mutziger, Dan Howes, and Sara Miller. Resumes for these individuals are also attached.

2. External Cooperators

There are no external cooperators scheduled for this program.

3. Partnerships

Districts that have already contacted ITRC and expressed interest in participating in this program include Merced Irrigation District, Turlock Irrigation District, Modesto Irrigation District, Western Canal Water District, and Alta Irrigation District.

Since the start of the USBR technical Services program in 1994, an estimated $2.1 million dollars have been expended by irrigation districts as a result of participation with the ITRC in the technical services program. All of the projects were the result of modernization of the district operations and represent cash outlays by the district. This does not include the additional cost incurred by the districts for equipment, labor, or facilities use. The grants provided to ITRC during this time period were approximately $2 million. This cost share component of the USBR contract with ITRC represents well over a 50% cost share by the local irrigation districts to participate in this modernization effort.

E. COSTS AND BENEFITS

1. Budget Summary

The following is the estimated breakdown of the budget for 3 years. The total amount requested is **$300,000.**

	Year 1	Year 2	Year 3
salaries and wages	$50,877	$50,232	$50,232
fringe benefits	$9,590	$9,397	$9,397
supplies	$6,607	$6,445	$6,445
equipment	0	0	0
travel	$7,000	$8,000	$8,000
other (direct costs)	$25,926	$25,926	$25,926
total	$100,000	$100,000	$100,000

Based on the experience with the USBR Mid-Pacific Region, it is estimated that the irrigation districts will easily provide a 50% cost share for this program at a total value of **$300,000**.

2. Budget Justification

Salaries and overheads used in developing this cost estimate were based on existing contracts with the USBR and California Energy Commission and the Cal Poly ITRC. A detailed summary of the proposed budget estimates is included as an attachment in the format required by Cal Poly.

3. Benefit Summary.

Each irrigation district is unique with regards to age, size, type of distribution system, water quality, topography, etc. The infrastructure of all of these districts was designed and constructed prior to the advent of modern on-farm irrigation technology, and prior to the adoption of the Public Trust Doctrine that requires a very strict accounting of the reasonable and beneficial use of water.

The Public Trust Doctrine recognizes that sagacious water use by all segments of California is a key to a healthy economy and environment. Furthermore, legislative and judicial decisions related to water marketing are opening the possibility for large scale water transfers. However, unresolved technical issues prevent irrigation districts from rapidly modernizing; thus, **multiple opportunities to be more energy efficient in the pumping and distribution of agricultural water are missed**. Also, these unresolved issues prevent us from having a clear idea of the amount of conservable water that is available. This proposal will help address these issues.

As stated earlier, the existing USBR technical assistance program in partnership with the ITRC has been identified as a **positive** program by the irrigation districts. Irrigation districts are actively pursuing modernization efforts, but they need specialized, high-level outside assistance to enhance their in-house and traditional engineering expertise. This technical assistance program proposal for all irrigation districts in California has multiplying benefits because it allows the districts to allocate financial resources spend their own (and CALFED) funds more wisely, while serving as good examples for neighboring districts. The program also fills an information transfer gap in important subjects such as irrigation scheduling and on-farm irrigation system design.

The technical assistance program is targeted towards the end-users (water district personnel and farmers) of the information, and towards individuals and organizations (such as irrigation dealerships) that have a multiplying effect. It addresses the "how to" questions that always accompany policy changes.